JACC: CARDIOVASCULAR INTERVENTIONS
VOL. 8, NO. 8, 2015

ISSN 1936-8798/$36.00
PUBLISHED BY ELSEVIER INC.
http://dx.doi.org/10.1016/j.jcin.2015.03.025

Tricuspid Valve Replacement

A Percutaneous Transfemoral Valve-in-Ring Approach

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We describe a percutaneous transcatheter tricuspid valve-in-ring implantation using the Sapien XT prosthesis (Edward Lifesciences, Irvine, California) (1,2). A 68-year-old woman with rheumatic heart disease and 2 previous sternotomies including tricuspid valve repair with a 32-mm Carpentier-Edwards (Irvine, California) annuloplasty ring presented 2 years prior with severe tricuspid valve regurgitation (annulus dilation and tenting of the leaflet) and pulmonary hypertension (right ventricular systolic pressure of 46 mm Hg) related to left ventricular diastolic dysfunction. After multidisciplinary evaluation, a percutaneous approach was recommended to avoid increased risk of third-time redo sternotomy. The procedure was planned using a cardiac computed tomography-derived 3-dimensional printed model created using an Objet Connex 350 printer (Stratasys, Eden Prairie, Minnesota) (**Figure 1**). Using this model, the prosthesis size was selected and "test deployed" to verify adequacy (Online Video 1). The actual transcatheter tricuspid valve-in-ring implantation was performed in the hybrid operating suite under general anesthesia. The right common femoral vein was accessed percutaneously. With an Amplatz super-stiff wire (Boston Scientific, Marlborough, Massachusetts) acting as a rail, a 29-mm Sapien XT valve was advanced across the tricuspid valve annulus. The stented valve was balloon inflated with an additional 1 cc of contrast saline solution to achieve optimal conical deployment (**Figure 2**, Online Video 2). Transesophageal echocardiography showed only mild perivalvular regurgitation in the septal region, as predicted in the printed model. Post-procedural 2-dimensional echocardiography showed mild tricuspid valve regurgitation with a transvalvular gradient of 3 mm Hg (**Figure 3**, Online Video 3). The patient's dyspnea improved prior to discharge from hospital 4 days later. The long-term effectiveness of this off-label procedure is still unknown and warrants further studies.

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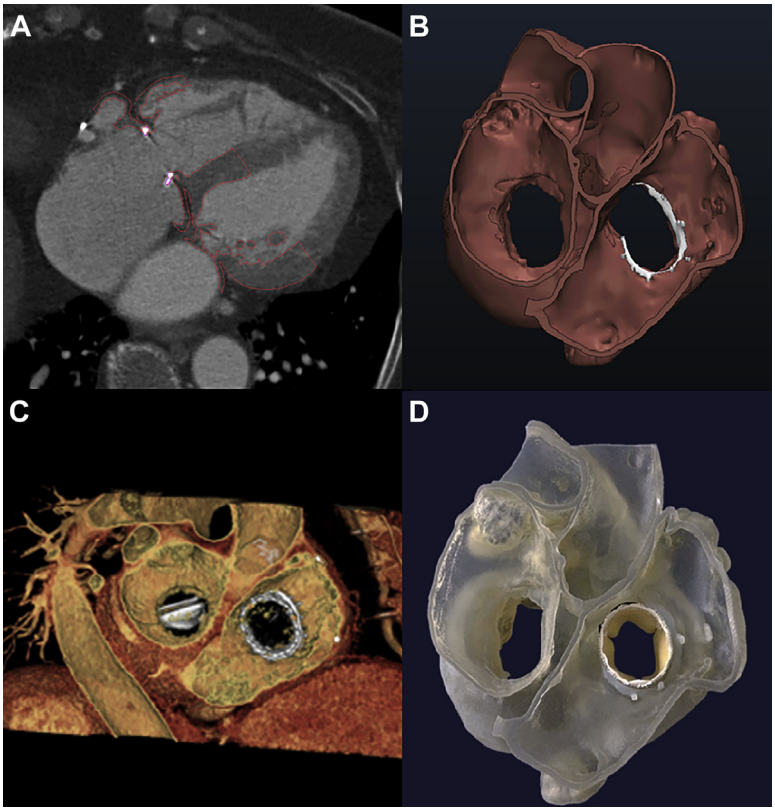
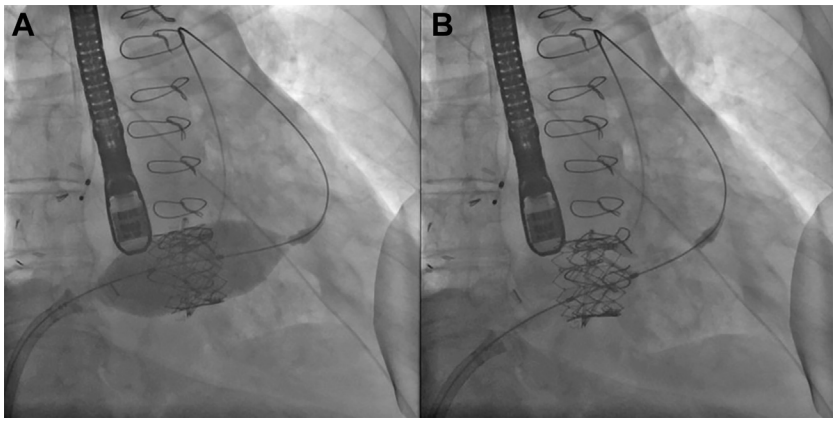
Manuscript received March 6, 2015; accepted March 12, 2015.

FIGURE 1 Pre- and Post-Procedure CT Imaging and 3D Printed Model



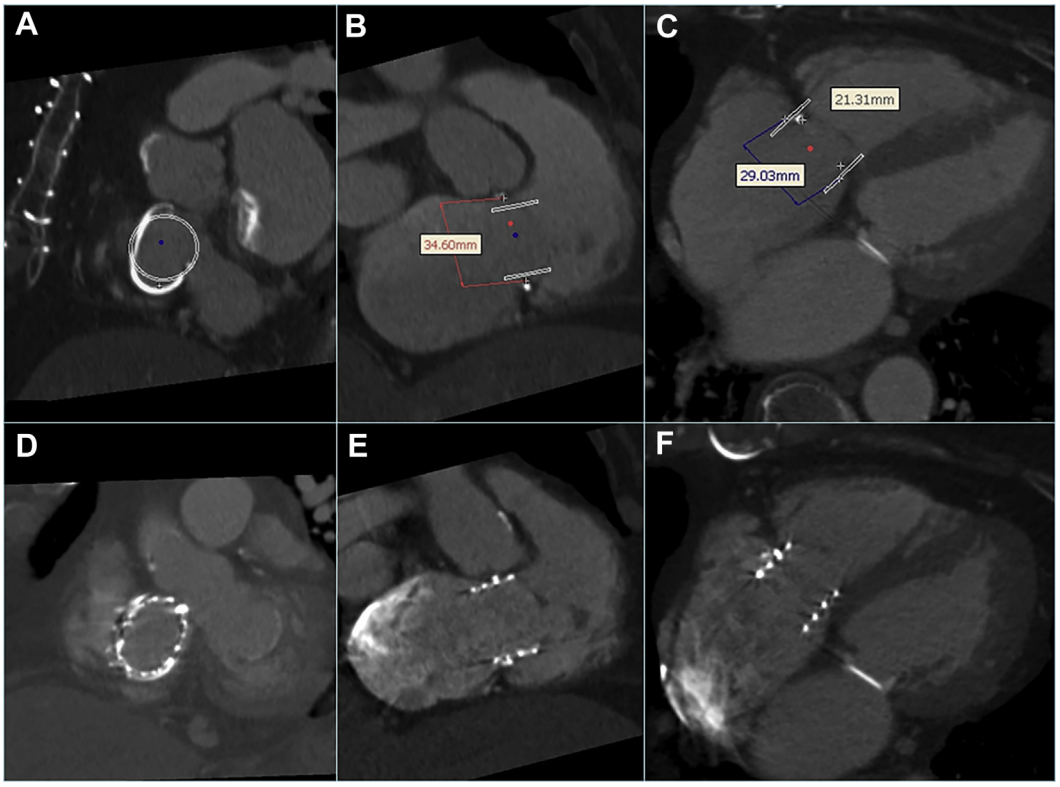
(A) Pre-procedure electrocardiography-gated cardiac computed tomography (CT) scan with the outline of the standard template library files (**red** and **purple outlines**) used for printing of the 3-dimensional (3D) model projected on the CT image. **(B)** The 3D reconstruction of the standard template library files showing the anatomy included in the printed model. **(C)** Post-operative volume-rendered 3D image showing the implanted Sapien XT valve within the annulus. **(D)** The 3D printed model, which is made up of acrylic-based photopolymer resins of differing stiffness for the annuloplasty band and myocardium. The appropriate size of the Sapien XT valve was pre-operatively determined using the model. See Online Video 1.

FIGURE 2 Fluoroscopy Images of the Procedure



(A) Additional 1 cc of contrast saline solution was used to achieve optimal conical deployment. **(B)** Post-balloon expansion of the Sapien XT valve image showing a well-seated valve with the majority of the stent on the right atrial side of the annulus. See Online Video 2.

FIGURE 3 Virtual Model of Sapien XT Projected on CT Image



Reformatted pre-procedure cardiac computed tomography (CT) images with "virtual" model of the 29-mm Sapien XT valve projected on the CT image in the tricuspid position **(A to C)** and reformatted post-procedure implantation cardiac CT images showing the position of the Sapien valve after implantation **(D to F)**. The valve stent appears well opposed to the annulus and annuloplasty band. See Online Video 3.

REFERENCES

1. Hoendermis ES, Douglas YL, van den Heuvel AF. Percutaneous Edwards Sapien valve implantation in the tricuspid position: case report and review of literature. EuroIntervention 2012;8:628–33.

2. Raval J, Nagaraja V, Eslick GD, Denniss AR. Transcatheter valve-in-valve implantation: a systemic review of literature. Heart Lung Circ 2014; 23:1020–8.

KEY WORDS Sapien XT, transcatheter, tricuspid valve, valve-in-ring

APPENDIX For supplemental videos, please see the online version of this paper.